Projecting Supply & Demand in the CAP Service Area

GWAC Long-Term Augmentation Committee

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YOUR WATER. YOUR FUTURE.

Supply, Demand & Uncertainty

Some of the major factors that affect water supply, demand and reliability:

- Growth
- Shortage
- Climate
- Socioeconomics
- Sector Trends
- Policy Changes
- Behavioral Shifts
- ….

"Driving Forces"

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Complexities

- **Relationships among supply & demand factors**
  - Within demand (e.g., housing development on Ag land)
  - Within supply (e.g., use of long-term CAP contracts affects Excess CAP)
  - Between supply & demand (e.g., reductions in interior use affect effluent supplies)
- **Significant uncertainties across multiple dimensions**
  - The rate of growth
  - The location of growth
  - Changes in current and future demand factors
  - The use of different supply types
  - The reliability of those supplies

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CAP Service Area Model (CAP:SAM)

- Tool for projecting supply and demand in CAP's three county service area
- Accounts for complex legal and physical characteristics of users and supplies
- Can simulate a wide range variations of "driving forces"
- Designed to generate "what if" scenarios

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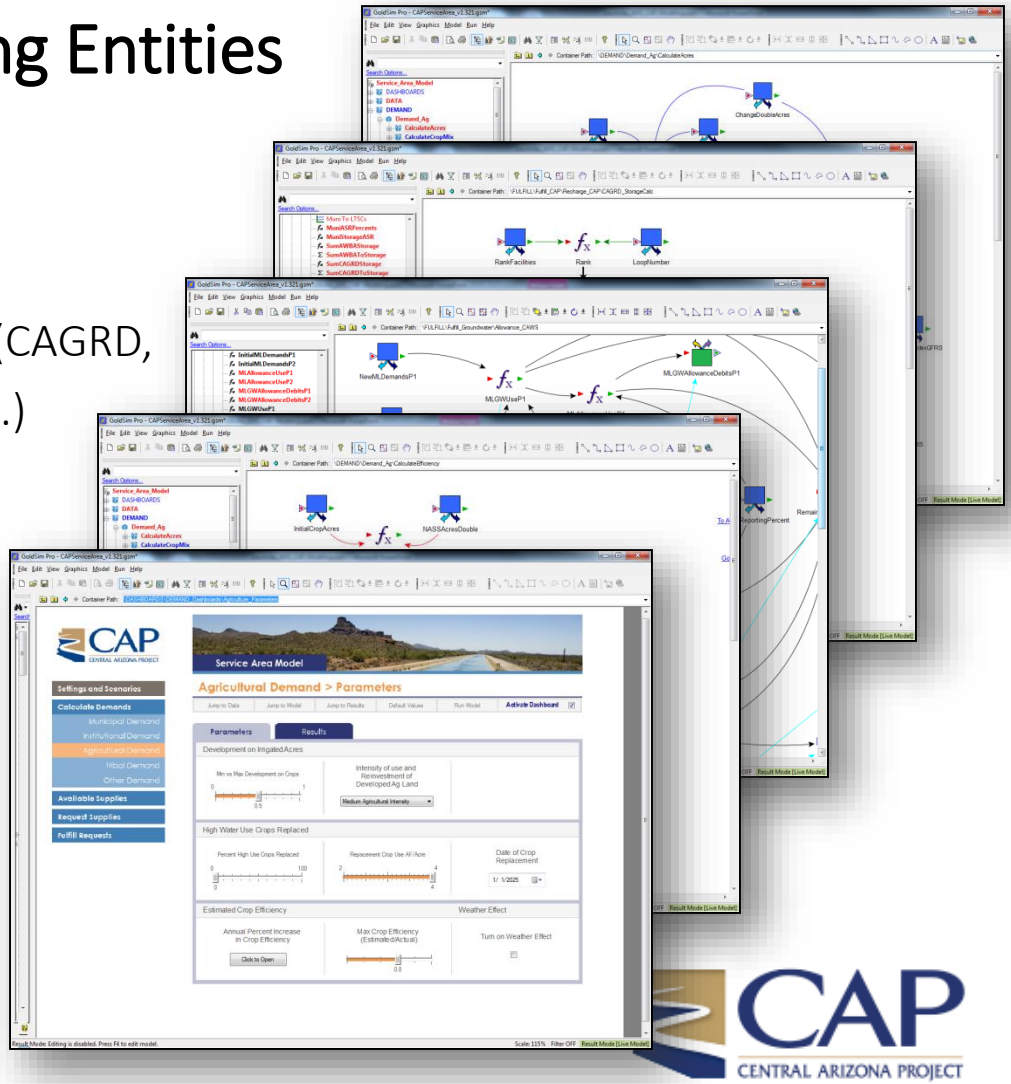
CAP Service Area Model (CAP:SAM)

- All Major Water Using Entities
  - 80 Municipal Providers
  - 23 Irrigation Districts
  - 12 Tribes and Districts
  - 20+ other user categories (CAGRD, AWBA, Industrial users, etc.)
- 16 Water Supply Types
  - Includes Surface Water, Effluent, CAP, LTSC, Groundwater, Recovered Water, etc.
  - Incorporates shortage scenarios from Colorado River Simulation model (CRSS)



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CAP Service Area Modeling Steps

Highly Stylized Process & Example

Demands: Generally developed without regard to the availability of supply. If a demand is supply defined (e.g., AWBA) the demand is unlimited (i.e., 999).

Project Demands

Time →

Demands	
Entity	Demand
Ag 1	500
Muni 1	150
Muni 2	100
AWBA	999

Determine Supplies

Available Supply			
Preference	1	SW	50
	2	CAP	507
	3	GW	999

Available Supply: Overall physical/legal availability. The order of preference determines the overall sequence used in the "Fulfill Requests" step.

Fulfill Demands

SW: The 50 AF is divided between Muni 1 & 2 on the basis of their entitlements/requests (50 & 100).

SW: Prorate	
Muni 1	17
Muni 2	33

CAP: Fill by Priority			
Priority	1	Muni 1	50
	1	Muni 2	67
	2	Ag 1	200
	3	AWBA	190

CAP: Muni 1 gets its full entitlement; Muni 2 only needs 67 AF to satisfy its remaining demand. Ag gets its request. AWBA gets what is left.

GW: Fill Remainder	
Ag 1 GW	300
Muni 1 GW	83
Muni 2 GW	0

GW: All unsatisfied demand is met with GW (if requested/entitled).

Request Supplies

Supply Requests: Generally the same as the entitlements, but Ag 1's request for CAP less than their allocation.

Supply Requests			
Entity	SW	CAP	GW
Ag 1	0	200	999
Muni 1	50	50	999
Muni 2	100	100	999
AWBA	0	999	0

Entitlements: Rights, contracts and policies

Entitlements			
Entity	SW	CAP	GW
Ag 1	0	300	999
Muni 1	50	50	999
Muni 2	100	100	999
AWBA	0	999	0

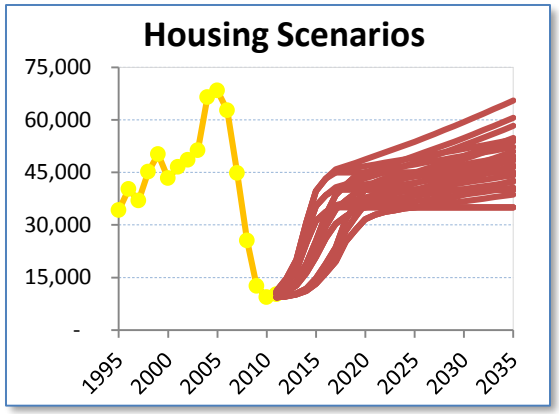
Results

Supplies = Demands			
Entity	SW	CAP	GW
Ag 1	0	200	300
Muni 1	17	50	83
Muni 2	33	67	0
AWBA	0	190	0

Growth

Both the rate of growth and the location of growth are critical

- Rate
  - Affects total use of supplies
- Location
  - Different water use characteristics for each utility
  - Different water supply portfolios
  - Different regulatory and institutional requirements



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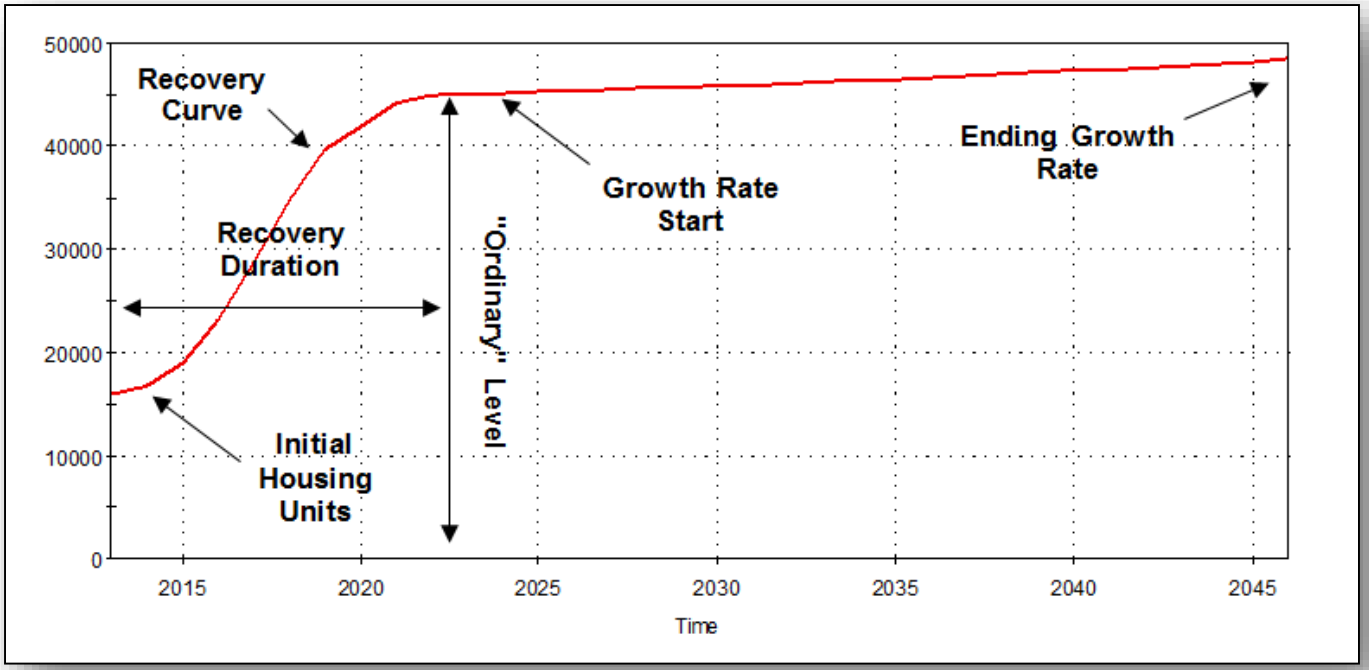
Growth Rate

- Annual housing unit growth can be adjusted to account for the effects of the recession, and longer-term trends



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Growth Ra

- Annual housing
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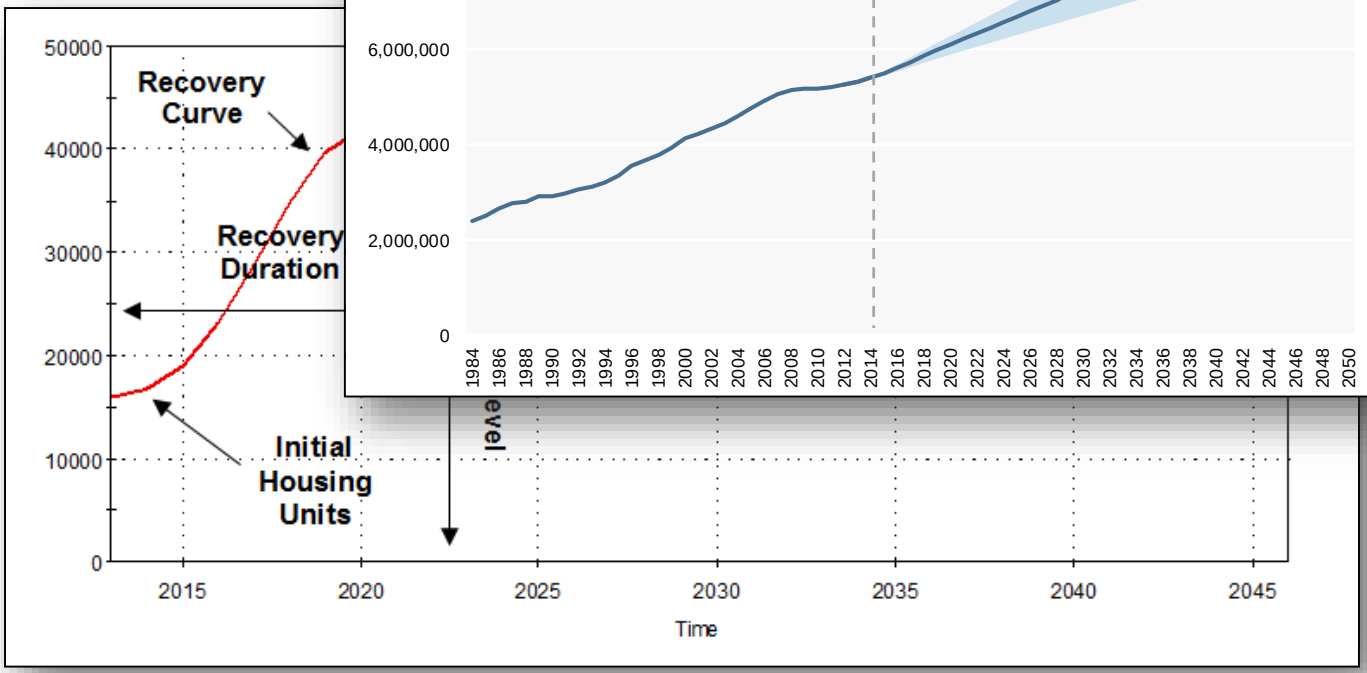
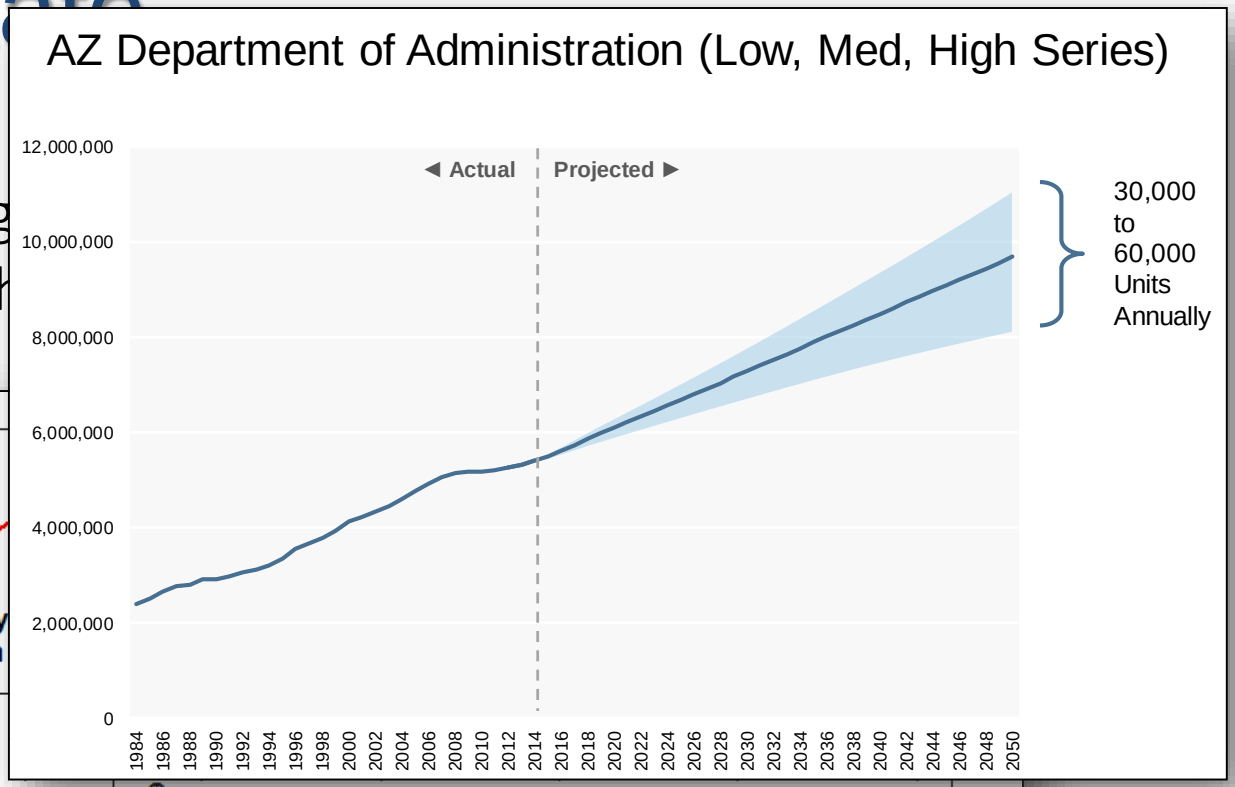
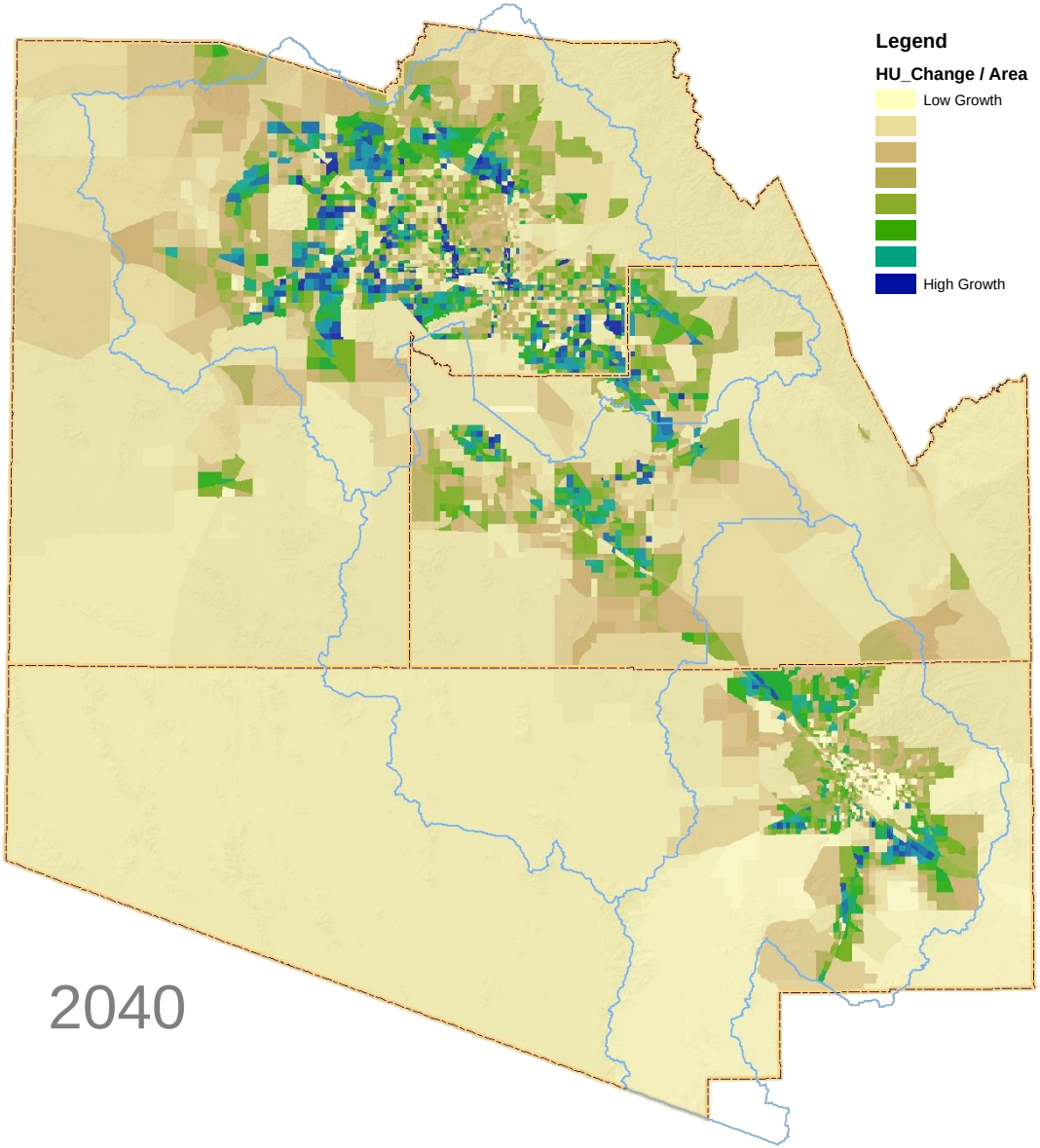




Growth Location



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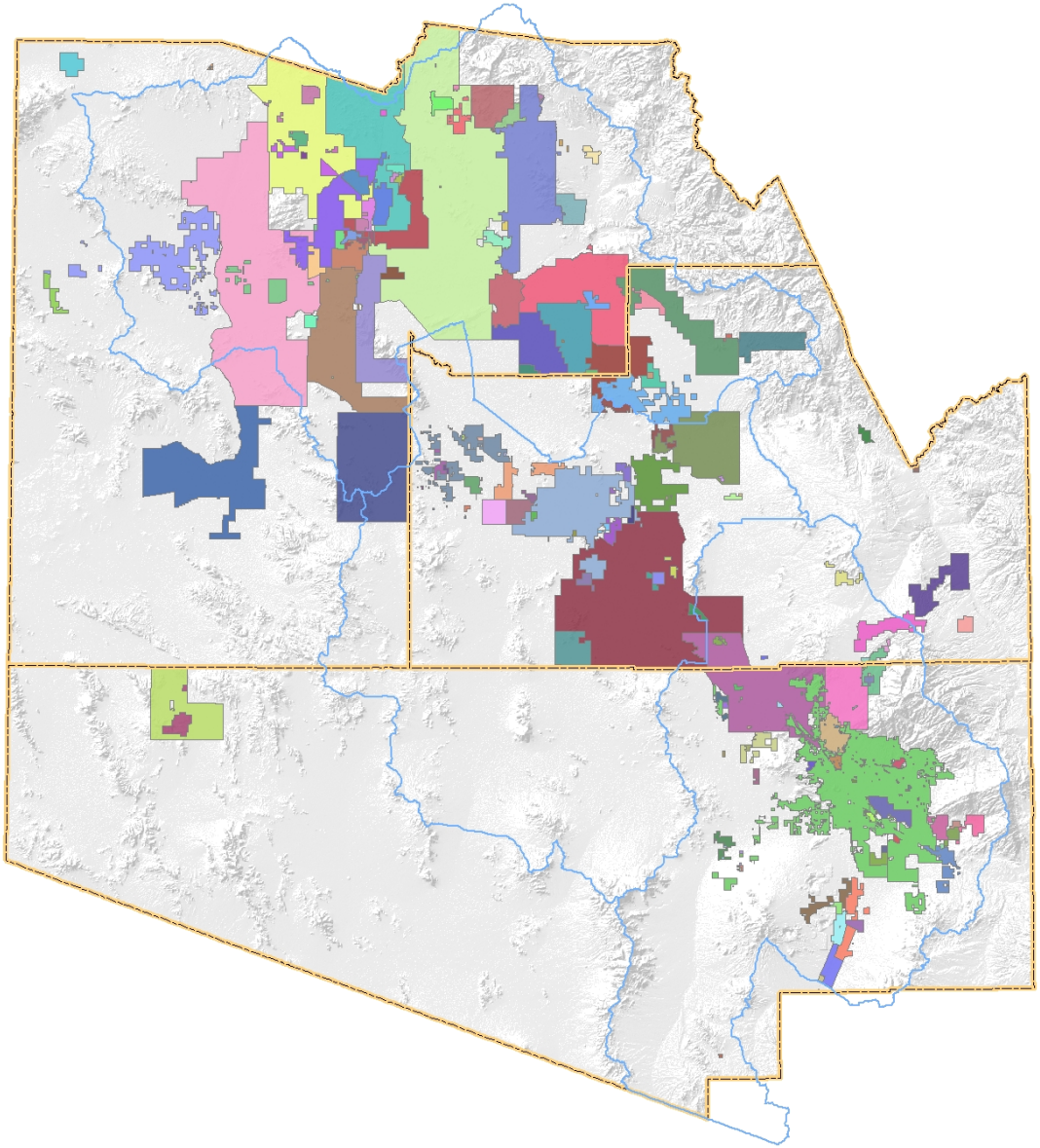
Water Provider Overlay



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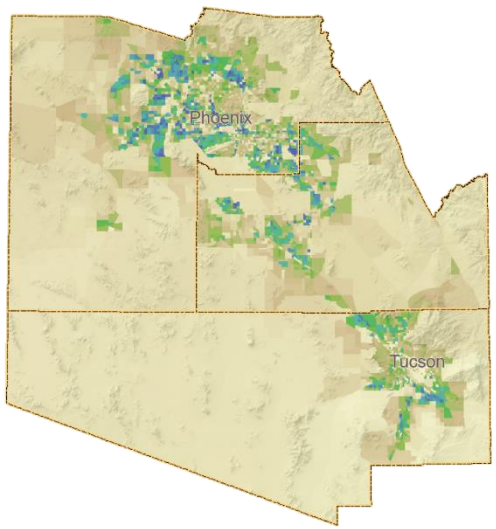
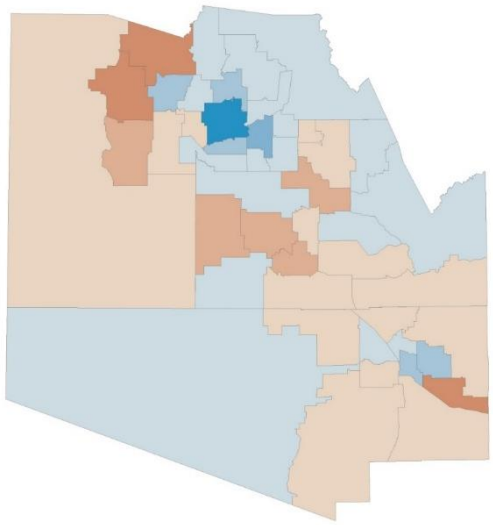
Growth Scenarios

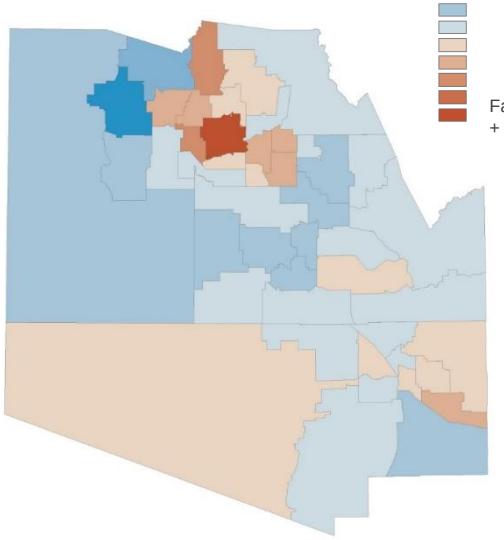
- Based on a model developed by *Applied Economics*
- Considers: historical growth, development projects, employment centers, transportation infrastructure, and land value



Baseline



Outward Growth



Compact Growth

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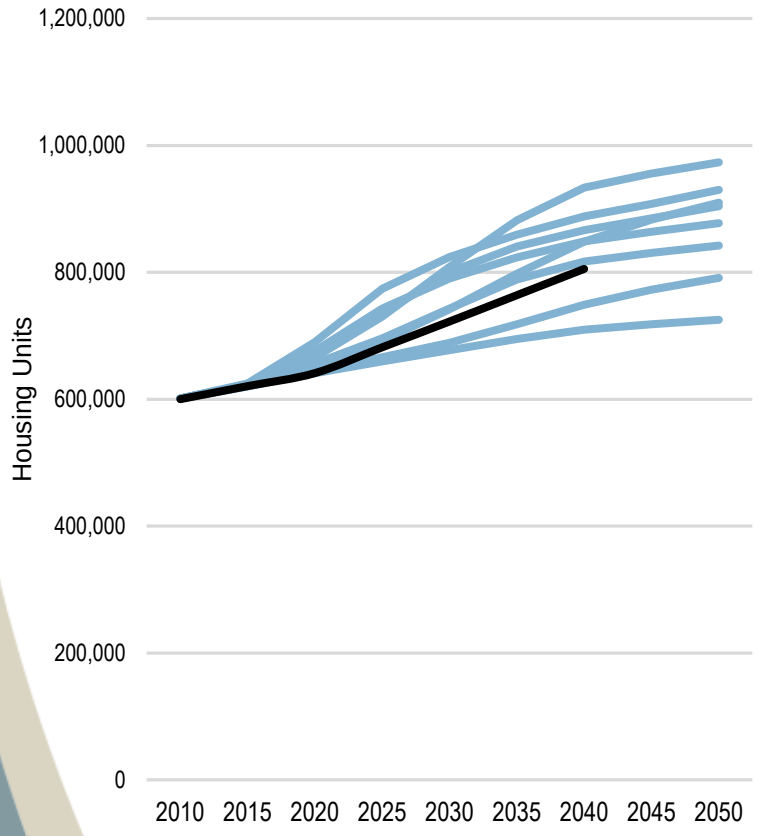
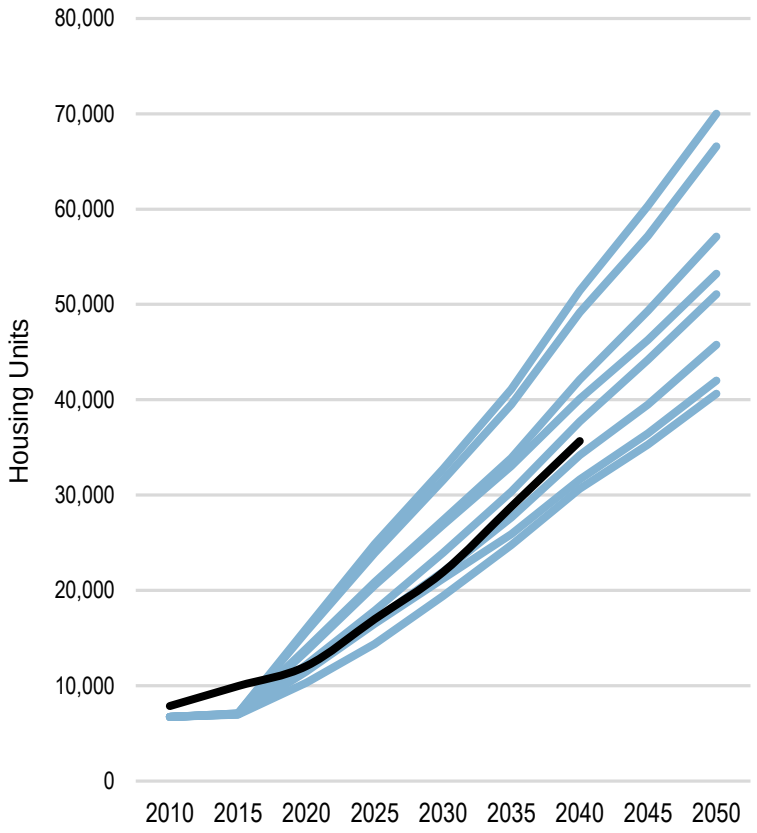
Growth Scenarios

Large Urban Provider



Growing Rural Provider



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Municipal Demand & Supply

- Demand
  - Housing units are multiplied by a provider-specific value of Gallons Per Housing Unit per Day (GPHUD)
  - Can adjust rate of change, and minimums and maximums
  - Separate calculations for new and existing housing units
- Supply
  - Each water provider's unique supply portfolio is included
    - Annual supplies (e.g., CAP, surface water, effluent)
    - Volumetric supplies (e.g., LTSCs, GW allowances)
  - Accrual (and debiting) of long-term storage credits is modeled, as is incidental recharge and Pinal renewable GW allowances
  - Leases, exchanges, transfers and reallocations through time can also be modeled

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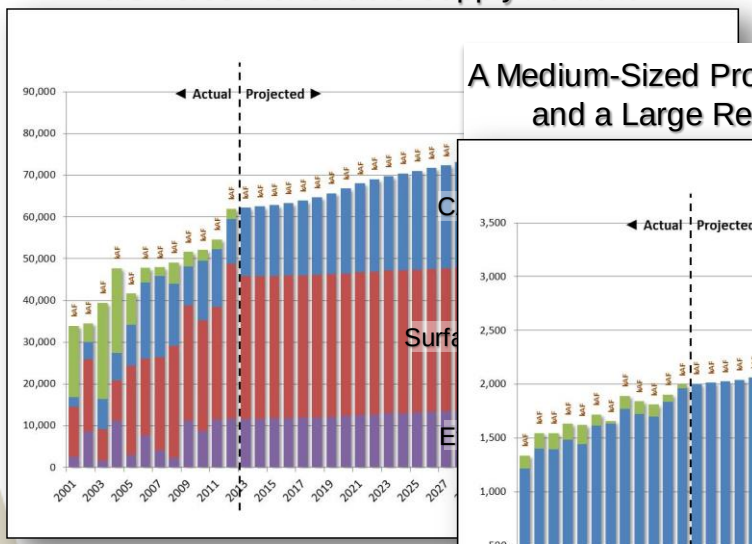
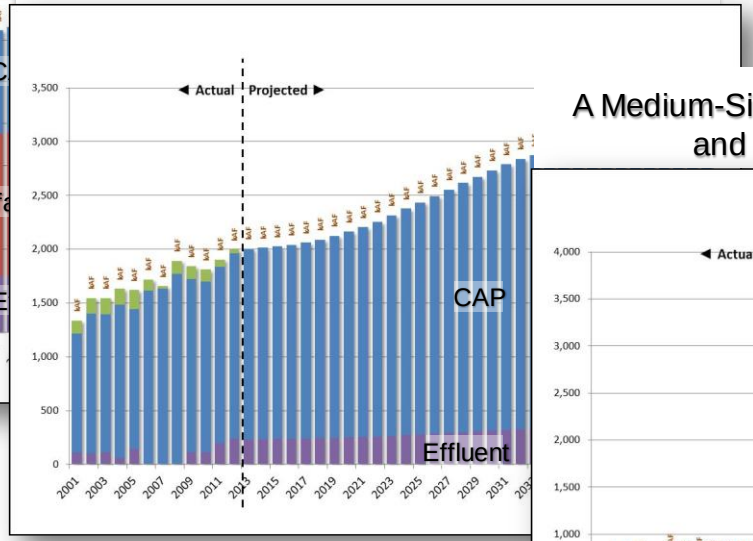
Municipal Demand & Supply

- A unique projection is developed for each water provider

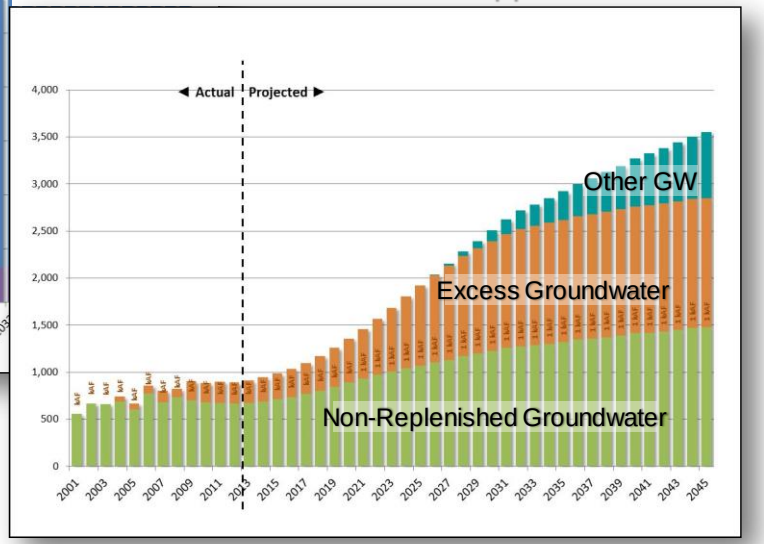
An Established City, with Moderate Growth, and a Diverse Renewable Supply Portfolio



A Medium-Sized Provider, with Moderate Growth, and a Large Renewable Supply Portfolio



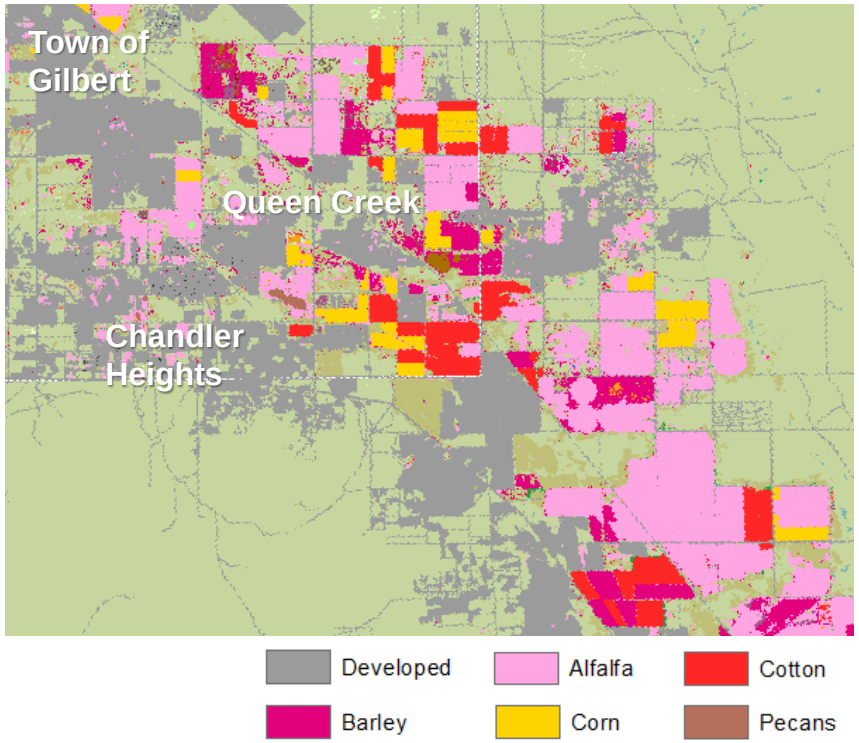
A Medium-Sized Provider, with Rapid Growth, and No Renewable Supplies



Agricultural Demand & Supply

- Data from several sources:
  - Acreage by Crop Type (NASS, 2008-2014)
  - Usage by Supply Type (ADWR, 1985-2013)
  - Crop Consumptive Use factors (ADWR)
- CAP:SAM can simulate changes in efficiency, crop mix and climate-based changes in evapotranspiration

National Agricultural Statistics Service CropScape Data Layer, 2013



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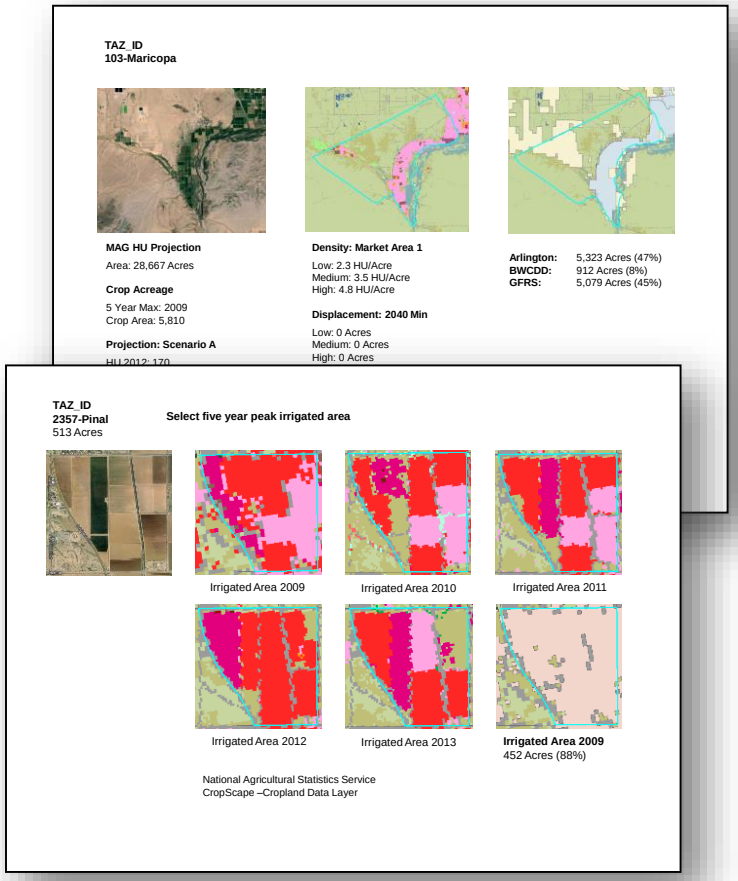
Agricultural Urbanization

- Projected urbanization is based on the housing unit projection and growth scenario
  - The relative “preference” of development on active Ag land vs. adjacent desert land can be simulated
- Ag demand by district is recalculated based on the remaining acreage



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Other CAP:SAM Features

- Dynamic allocation of water to recharge facilities (USF and GSF) based on each entity's storage preferences and available capacity
- Calculation of recovery of water stored by the Arizona Water Banking Authority
- Calculation of CAGRD replenishment obligation
- Integration with stochastic output from CRSS
- Ability to quickly generate alternate scenarios

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Current Status

- Model is constantly being improved
  - Effluent production and fate
  - Subcomponents of municipal demand
  - Refined assumptions of SRP supply
- Being used to support to two “Basin Studies”
  - West Valley Water Association (formerly WESTCAPS)
  - Lower Santa Cruz River Basin (i.e., Tucson AMA)

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